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tions in history are liable to revision in the same way as are theories in science. Any interpretation, any inference, depends upon the application of judgments claimed to be eternally true, but which are, therefore, not existential, while any statement about existing things depends upon the information at hand about the things in question.

It may be replied that the progressive revision of scientific descriptions approaches a limit where the information will be all in, that although this limit may be never reached, nevertheless it is a logical term in the series of descriptions each of which is the correction of a preceding one. What is here claimed is, at the same time, a confession. It is a "logical" term, *i. e.*, it depends upon an assumption. And the assumption is evidently that of a bounded universe. The discussion of this concept would be too far-reaching to be possible here, but two things may be said. The bounded universe is a sufficiently evident fact in the eyes of primitive folk, and it was appropriate to the theology of St. Thomas and the poetry of Dante, but our experience and science hardly reveal anything of the sort. And in the second place, as the arrival at the above-mentioned limit is an event indefinitely remote, it does not confer finality upon this or that specific conception of existence.

I would gladly agree with my critic, and I would not be understood to say that the principle *sub specie æternitatis* has no application. It has, however, the only application which a dialectical principle can have: what is it but the principle of contradiction endowed with the sympathy of a certain human contact and with the dignity of a dramatic universality? And here in the principle of contradiction we have, to be sure, a truth that is eternally true.

Again I ask, why is provisional truth about empirical existence so unsatisfactory? Is there any way of accounting for the exaltation of eternal truth except the persistence of that eighteenth-century enthusiasm for deduction which has caused philosophy to be, even down to our own day, so much more a matter of syllogisms than of observation and inquiry?

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REVIEWS AND ABSTRACTS OF LITERATURE

The Dancing Mouse: A Study in Animal Behavior. ROBERT M. YERKES. New York: The Macmillan Co. 1907. Pp. xxi + 290.

This study is the nearest approach yet made by any student of behavior to giving a complete and systematic account of the varieties and complexities of the actions of a mammalian race. Comparative psychology is advanced by it both from the standpoint of methods of experimentation and from that of the facts which it actually contributes.

The book systematically covers a wide field both historically and experimentally. On account of its comprehensiveness, it stands in pleasing contrast to the interesting, but isolated, bits of natural history which at the present time comprise the factual side of the science of mammalian behavior.

In regard to the time and place of origin of the race of dancing mice, the animals which are the subjects of all of Dr. Yerkes's experiments, the author makes the statement "that a structural variation or mutation which occasionally appears in *Mus musculus,* and causes those peculiarities of movement which are known as dancing, has been preserved and accentuated through selectional breeding by the Chinese and Japanese, until finally a distinct race of mice which breeds true to the dance character has been established. The age of the race is not definitely known, but it is supposed to have existed for several centuries" (p. 15).

Dr. Yerkes treats in two chapters ("Dance Movements" and "Equilibration and Dizziness") of the peculiar movements of the dancer. He discusses these movements both from the standpoint of the literature and in the light of his own observations. Six peculiarities of behavior are noted: (1) The dance movements—whirling, circling, figure-eights, zigzags; (2) restlessness and the quick jerky movements of the head; (3) lack of responsiveness to sounds; (4) more or less pronounced deficiency in orientational and equilibrational powers; (5) lack of visual dizziness; (6) lack of rotational dizziness.

The anatomical and histological work upon the structure of the ear of the dancer is next examined, in order to find a structural basis to which the functional variations just mentioned might be assigned. The author finds reason to doubt the conclusions advanced by Rawitz to the effect that the dancer possesses only one normal canal, the anterior vertical, and that the nervous elements of the cochlea are degenerate. The following quotation from the author serves to give us his position upon the possibility of correlating peculiarities of function with variations in structure: ". . . no structural conditions have been discovered which account satisfactorily for the dancer's peculiarities of behavior. That the ear is unusual in form is highly probable, since three of the four investigators who have studied it carefully agree that it differs more or less markedly from that of the common mouse." ". . . . the status of our knowledge of the structure of the central nervous system is even less satisfactory if possible . . ." (p. 71).

The author finds that while the adult animals are wholly insensitive to auditory stimuli, the young, at least those belonging to certain lines of descent, are sensitive to such stimuli at a short, but definite, period of their lives. His table (p. 89) shows that in these young animals auditory responses may be obtained at the thirteenth, fourteenth, or fifteenth day (the exact age at which such responses may be observed varies from individual to individual) and continue roughly for from two to four days. In the young of another line of descent, no auditory reactions were obtained at a corresponding age or at any later age.

Five chapters of the book are devoted to the sense of sight. Two of these are given over to brightness vision, two to color vision, and one to the role of sight in the daily life of the dancer. Before taking up the results and methods in detail, it may be said that Dr. Yerkes has intelligently and systematically maintained the difficult control factors necessarily involved in the successful carrying out of such experiments.

Since, according to the author, the dancer does not withstand the effects of hunger, and even when hungry does not ordinarily show eagerness to search for food, some other stimulus than that of food had to be sought. The author finds that he may control the naturally abundant and incessant activity of these animals by the use of the electric induction shock. Punishment instead of reward is thus used for forcing the animal to make a discrimination.

The method as applied in these experiments follows in detail: A discrimination box (visual), consisting of a large nest compartment containing food and room for dancing (the latter is an important factor), and a large entrance compartment, containing a door which could be opened by the animal from the end nearest the nest-box. At the farther end of the chamber, two doors, right and left, led, respectively, to two electric-boxes, the floors of which were arranged to give the animal a weak induction shock whenever the experimenter so desired. An opening led from each of these electric-boxes through an alley back to the nest-box. An opportunity for visual discrimination by brightness difference was provided by placing dead-black cardboard at the entrance to one of the electric-boxes and white cardboard similarly at the entrance to the other box. These cardboards were movable and could be attached to the openings leading to the one or to the other box at the will of the experimenter. The mouse was required to choose the entrance surrounded by white cardboard. If this were done the animal could return to the nest-box without receiving an electric shock (the electric shocks were given whenever the mouse entered the electric-box the entrance to which was surrounded by black cardboard). Without entering into Dr. Yerkes's elaborate control tests, it may be said that the mice learned to discriminate perfectly the white cardboard from the black. Efforts were then made to determine how slight a difference in brightness enables the dancer to discriminate one light from another. Two methods of stimulation were used: (1) light was reflected from Nendel's gray papers; (2) white light (electric incandescents) was allowed to illuminate two compartments. These compartments were illuminated separately, the light emanating from above.

Those animals which had already learned to discriminate white cardboard from black in the apparatus just described were tested in the same apparatus again, only the black and white cardboards were replaced by light gray paper (No. 10) and dark gray (No. 20). It was found that they did not always choose the brighter of the two grays as was expected—a certain training period was necessary in order to perfect discrimination. Dr. Yerkes infers from numerous further tests with gray papers that the amount by which Nendel's gray No. 10 differs in brightness from No.

20 is near their threshold of discrimination. In the experiments with transmitted light, the author attempts to answer the question whether Weber's law in any form holds for the brightness vision of the dancing mouse. He became convinced, after many tests, that Weber's law does not hold for the brightness vision of the dancing mouse. Attention is called to the fact that in this test with transmitted light the author apparently does not rule out the possible disturbing influence of possible differences in temperature between the two light compartments.

In the first series of tests on the color vision of these animals colored papers were used as stimuli and found to be unsatisfactory. Approximately monochromatic light filters were then employed. The author characterizes the red as "perfectly satisfactory," the blue-violet as "good" and the green as "poor." After conducting an enormous number of careful tests, he concludes (p. 176) " . . . that, although the dancer does not possess a color sense like ours, it probably discriminates the colors of the red end of the spectrum from those of other regions by difference in the stimulating value of light of different wave-lengths, that such specific, stimulating value is radically different in nature from the value of different wave-lengths for the human eye, and that the red end of the spectrum has a very low stimulating value for the dancer." He then goes on to say that most of the experiments which have hitherto been carried out upon color vision in animals have really failed to touch the color vision problem at all, because sufficient care has not been taken to separate the brightness factor from that of hue—a statement which the reviewer can heartily concur in.

Interesting chapters are devoted to methods of learning, habit formation, efficiency of training methods, the duration of habits, individual, age, and sex differences, and to the inheritance of forms of behavior. It is of interest to note that the author finds that the dancer can be aided in the solution of a problem by being put through the necessary acts. He failed to find the presence of imitation after very careful tests. "Although abundant opportunity for imitation in connection with the opening of the doors in the discrimination box was given to twenty-five individuals, I obtained no evidence of the ability to learn by imitation." This apparent lack of imitation in the dancer is rather surprising in view of the fact that Berry[1] finds evidence for both instinctive and voluntary forms of imitation in the white rat—an animal which the reviewer believes has far less acuity of vision than the dancing mouse.

The author finds no evidence for the belief that a particular form of behavior acquired during the lifetime of an individual can be transmitted by that individual to its offspring.

This work has set a high standard in the field of behavior. Any departure from its tenets in the way of lessening the control of experimental conditions would be a step in the backward direction. The only thing in the way of criticism which can be made about the volume is concerned with the author's rather sweeping condemnation of the use of food as a stimulus in controlling the reactions of animals, and the installation of punishment in its place.

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[1] *Journal of Comparative Neurology and Psychology*, Vol. XVI., No. 5, 1906.

Dr. Yerkes speaks of the inhumaneness of the hunger method. Surely he can not be unaware of the statements of many of the men using this method, to the effect that their animals are not starved, that they get their hunger completely satisfied after the day's tests, and that they remain in better health during experimentation than when idle and surrounded by food. His broad statements will lack experimental support until he has put down in parallel columns the behavior records of two sets of animals, the one set reacting to food, the other to the electrical shock, and these parallel records should be taken from experiments on "many mammals" and not from those on the dancer alone. To these items he would likewise have to add a record of the body weights of the two sets of animals during the period of experimentation (the reviewer has tested the body growth, using increase in weight as an index of growth, of young rats under conditions of training, and has found it normal).

While not condemning the punishment method, it would seem that it must be admitted that its employment in any but extremely simple forms of apparatus, such as that used in discrimination tests, is extremely burdensome and clumsy. Even in discrimination tests, where the difference in the stimuli to be reacted to is slight, the method is used at a peculiar disadvantage because repeated tests in which the animal constantly makes failures, leading always to a shock, tend to make the animal hesitant about reacting at all, and at such times it, at all costs, ought to be kept free from such disturbing influences. Judging from Dr. Yerkes's experiments, where he attempts to find an auditory function in these animals (p. 84) there is a deleterious summation effect which forever precludes the possibility of making the punishment equal from test to test (which is Dr. Yerkes's main contention) regardless of how constant the physical properties of the induction shock are maintained.

But can such a stimulus be kept constant? On the physical side the strength of the battery varies, the perfectness of the contacts varies; likewise the temperature of the wires varies; the animal may happen to tread simultaneously upon the two wires now here, now there, consequently the circuit is completed when a varying resistance is present. On the physiological side, two animals in all probability never offer the same resistance to the current, the difference being due to the physiological state of the organism; two animals differing in weight receive a varying amount of shock, the heavier animal, other conditions being the same, making the more perfect contact. But probably more important than any of the above are the facts that the moisture and cleanliness of the feet differ in different individuals and in the same individual from time to time. These difficulties in the way of using the induction shock in the manner suggested by the author may be for the most part entirely chimerical, but at least the burden of proving that they are insignificant lies with Dr. Yerkes—their insignificance can not be assumed. As an auxiliary method (to be used in connection with food) having its *raison* *d'être* in the hastening of a discrimination or an association, we may grant its possible usefulness, but to the propositions that it is more "humane" and that it can be substituted in most situations for the more natural method of using food as a stimulus, we can not agree.

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A Student's History of Philosophy. ARTHUR KENYON ROGERS. Revised edition. New York: The Macmillan Co. 1907. Pp. xiii + 511.

In a department of literary activity in which English written books are not too common, Professor Rogers has achieved a distinct success. Hitherto the Germans would seem to have had a monopoly in the writing of the history of philosophy. We have many admirable translations, but very few original treatises. That there was need for such a work as Mr. Rogers has produced, and that this volume has helped to supply the want, the fact that it has attained to a second edition amply proves. As its name indicates, this book is primarily intended for students, but the cultured world generally will find it interesting and instructive. Within the limit of five hundred pages the author has succeeded in presenting a most luminous, well balanced, and comparatively full treatment of the history of philosophy from its beginnings in Greece to our own times.

There are several features of this work which commend it. For one thing, it is written in clear and simple language, largely avoiding many of those technical terms which are so apt to confuse and repel the young student. Again, it gives exceedingly full extracts from the books dealt with, thus bringing the reader into contact with the various writers themselves. And once more, a unifying principle of development is exhibited in the volume which shows that the history of philosophy is not a series of haphazard isolated opinions, but really a connected whole.

In comparing the first edition with the second, one observes that considerable improvements have been made by way of both omissions and additions. Some parts of the introduction have been left out, and the treatment of Fichte has been curtailed. On the other hand, the section on Kant has been rewritten and augmented; also a brief account of current thought has been appended. As the author himself says, the relative space given to different topics must be a matter of individual judgment. But we feel that while the treatment of Plato is satisfactory, some elements in Aristotle have been overlooked. Again, while our author has done ample justice to Locke, Berkeley, and Hume, he dismisses the Scottish school of common sense with less than a page, barely mentioning Sir Wm. Hamilton. Kant and Hegel, as befits their epoch-making importance, have, each, a considerable space allotted to them; but Herder and Lessing, Fichte and Schelling, are rather summarily dealt with; while Jacobi and Herbart, not to speak of Schiller and Schleiermacher, are omitted. We notice that Mr. Rogers has added to the value of his treatment of Kant by now giving some account, though still rather slight,